MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR AND LAND PROTECTION DIVISION
ENVIRONMENTAL SERVICES PROGRAM
Standard Operating Procedures

SOP #: MDNR-FSS-005 EFFECTIVE DATE: May 5, 2003

SOP TITLE: General Sampling Considerations Including the Collection of Grab, Composite, and Modified Composite Samples from Streams and Wastewater Flows

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SUMMARY OF REVISIONS: Minor grammar and format revisions were made.

APPLICABILITY: Applicable to all ESP personnel who are involved in stream and wastewater flow sampling where verifiable and defensible field and analytical data are required.

DISTRIBUTION: MoDNR Intranet
ESP, SOP Coordinator
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RECERTIFICATION RECORD:

Date Reviewed				
Initials				

1.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) provides guidance for Environmental Services Program (ESP) personnel when collecting grab, composite, and modified composite samples from streams and wastewater flows. There are many methods of collecting samples, which range from a one-time grab sample to continuous flow-proportional sampling with automatic samplers. The method chosen is dependent on a number of factors including the intended use of the data, the physical arrangement at the sampling site, the analyses required and stipulated procedures such as those contained in state and federal laws and regulations.

The procedures contained in this document are applicable to ESP staff who are tasked with conducting field investigations that involve sampling from streams and wastewater flows.

2.0 HEALTH AND SAFETY REQUIREMENTS

2.1 Safety is always the number one consideration. If a sample cannot be collected safely, wait for help, wait until conditions improve, or reconsider the importance of the sample. Never enter a confined space to collect a sample (e.g. manhole, culvert, etc.) without the proper equipment and training.

2.2 All ESP personnel who conduct work at raw and treated wastewater or polluted waters will be required to participate in the department's medical monitoring program in accordance with divisional policy. In addition, employees should be familiar with the Hepatitis A prevention vaccine policy.

2.3 The sample collector shall use an appropriate level of personal protection based on the specific work being done. The minimum level of personal protection to be used is gloves, safety glasses, and waders.

3.0 PERSONNEL QUALIFICATIONS

Field personnel shall have a working knowledge of the field sample collection procedures (refer to MDNR-FSS-001 "Required/Recommended Containers, Volumes, Preservatives, Holding Times and Special Sampling Considerations", MDNR-FSS-002 "Field Sheet and Chain-of-Custody Record", MDNR-FSS-003 "Sample Numbering and Labeling", MDNR-FSS-004 "Field Documentation", and MDNR-FSS-018 "Sample Handling: Field Handling, Transportation, and Delivery to the ESP Lab") and have attended the department-sponsored Inspection and Enforcement training or received appropriate on-the-job training.

4.0 GENERAL CONSIDERATIONS

4.1 The purpose of any sample is to select a portion of a population which is representative of that population. Any influence imparted by the sampling effort that affects the representative nature of the sample defeats the purpose.

4.2 It is probably a rare occurrence when decisions made by the sample collector do not influence the outcome of the sample. Such variables as where to collect the sample, at what depth, grab versus composite, which automatic sampler to use, and at what frequency often require on-the-spot decisions and can have considerable influences on the quality of the sample collected. It is the job of the collector to minimize these influences.

4.3 Do not disturb the stream above the point of collection. Always face upstream when collecting a stream sample when wading is required, and do not walk in the stream above the collection point. If the stream will be disturbed by other activity such as flow measurement or biological sampling, collect the water sample first. Do not increase the velocity of a waste flow immediately prior to sampling (by lifting flap gate, lowering discharge line, etc.). If this cannot be avoided to collect the sample, wait a period of time until any solids picked up by the increased flow are purged.

4.4 Always ensure that sampling below the confluence of two or more streams is at a point where complete mixture has occurred. Straight channels exhibit laminar flow and may require long distances for lateral and vertical mixing. If sampling after mixture cannot be done, two or more samples transcending the stream width or depth may be required. Depending upon the sampling objectives, the samples can then be analyzed separately as grabs or combined and submitted for analysis as one sample.

4.5 Always use the correct sampling technique and handling procedure specified for the parameter of interest. Please refer to Standard Methods for the Examination of Water and Wastewater, 1998, 20th Edition, section 1060 for further discussion of proper sampling techniques. Points to consider are: container type, volume of sample needed to conduct analysis, required preservative, and holding time. Depending on the analyses required, several collection procedures may be used to collect a single sample (refer to MDNR-FSS-001, "Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations").

4.6 Avoid collection of large incidental materials such as sticks and leaves.

5.0 GRAB SAMPLES

5.1 A grab sample is one in which the sample collector obtains an individual discrete sample within a period of time not exceeding 15 minutes. However, you may exceed the timespan as long as the samples are collected continuously during that time span.

5.2 Although the collection of a grab sample is most commonly accomplished by submerging the sample container in the water being sampled, it can also be collected by use of a pump, spoon, Kemmerer or Van Dorn bottle, or other suitable device.

5.3 For the purpose of quantifying the characteristics of a water body or wastewater discharge, one grab sample is not generally considered sufficient. There are situations, however, where a grab sample is preferred over other types and, in fact, required for certain analyses. It is best to collect grab samples when:

- An automatic sampler will contaminate or otherwise alter the sample (bacteria, oil and grease, trace organics, etc.).
- The parameter is highly unstable (dissolved gases, temperature, etc.).
- Water quality conditions are transient such as a slug discharge or spill.
- The water body is relatively static such as pooled contaminants.

5.4 Special precautions to consider when collecting grab samples.

5.4.1 When submerging a sample container, avoid contaminating the sample with your hands. Furthermore, one should always wear clean gloves when collecting a sample. It may be helpful to hold the container well below the opening and move it away from you (upstream) as it fills.

5.4.2 When using a mechanical device, be sure it is appropriate for the parameter of interest. Avoid using a brass sampler for metal analyses for instance.

5.4.3 When collecting stream samples, try to select a point in the main flow. Avoid backwater areas and the shoreline when possible. It is often better to select a site either above or below a riffle to assure the main flow is being sampled.

5.4.4 When possible, collect lake samples by boat, avoiding the shoreline (unless the purpose of the sample is to characterize the shore areas). Most lakes stratify which results in significantly different water qualities above and below the thermocline. If the whole water column is to be characterized, several depths must be sampled.

6.0 COMPOSITE SAMPLES

6.1 Composite samples are samples formed by the collection of a series of discrete (grab) samples, either manually or automatically, and combining them into one (refer to MDNR-FSS-201, "Use, Cleaning, and Maintenance of ISCO Automatic Wastewater Samplers").

6.2 Collections of composite samples allow for an approximation of the average water quality over a given time or flow period. By collecting a number of grab samples and combining them into one, an approximation of water quality can be made without the prohibitive expense of analyzing each individual grab sample.

6.3 In general, composite samples should be collected when:

- Required by NPDES permit.
- Determining average concentrations over time.
- Calculating mass/unit time loading.
- When trying to characterize a substance.

6.4 Types of Composite Sampling Techniques used by the ESP. Refer to MDNR-FSS-201 for the Use, Cleaning, and Maintenance of the ISCO Automatic Wastewater Samplers.

6.4.1 Time proportional composites - This type of compositing is conducted by setting an automatic wastewater sampler to collect a constant volume of sample with a constant time interval between samples. This is the technique most often used by the ESP.

6.4.2 Flow proportional composites - This type of compositing is conducted by setting up an automatic wastewater sampler and flow meter so that the volume of sample collected is in proportion to the amount of flow leaving the discharge. With accurate measurements of flow, this technique can provide a more representative sample than the time-proportional method. The disadvantages are that a greater amount of equipment and manpower are needed for sample collection.

6.4.3 Modified composite - This technique is used primarily in situations where the use of an automatic wastewater sampler is not possible or practical. A modified composite is made by manually collecting a minimum of four samples no closer than 2 hours apart during a 24-hour period. These grab samples are then composited into one container for analyses. This technique is used only occasionally by the ESP due to the large amount of time and expense required for sample collection. Modified composite samples are collected when one of the following conditions exist:

- An automatic sampler is not available and a composite sample is essential.
- Security is a problem (potential theft or vandalism of sampler) and a composite is essential.
- Enforcement action requires unquestionable sample integrity (automatic samplers can almost never be set to completely prevent tampering).

7.0 AUTOMATIC WASTEWATER SAMPLERS

7.1 The ESP has two basic types of automatic wastewater samplers: the compositor and the sequential or discrete sampler. Refer to MDNR-FSS-201 for a complete discussion and operating instructions of each type.

In general, the compositor automatically deposits every sample into one container. The sequential sampler deposits each sample into individual containers that can then be analyzed individually or manually composited into one container.

7.2 Advantages and disadvantages of both types of samplers are given below:

Compositor	**Sequential**
• Sample already composited	• Requires manual compositing
• Sampling sequence cannot be observed	• Sampling sequence can be observed to record periods when sample was not collected
• Requires cleaning and replacement of only one container	• Requires cleaning and replacement of up to 28 containers

7.3 Several sampling considerations used when operating automatic wastewater samplers.

7.3.1 The appropriate containers, intake lines, and weighted intakes must be used depending on analyses to be performed. For example, when organics are to be analyzed, properly cleaned glass containers, Teflon intake lines, and Teflon or stainless steel weighted intake screens must be used. Refer to MDNR-FSS-201 for a more detailed discussion.

7.3.2 Whenever possible, when placing the intake line, suspend it at mid-depth in the waste stream to obtain as representative a sample as possible. Avoid placing the line on the bottom or next to sides of the discharge

especially if large amounts of solids are present. Avoid back-eddies or any other areas that appear to be different from the main stream.

7.3.3 The interior compartment surrounding the sample container should always be stocked with ice to aid in preservation of samples. Ice should never be put directly into the sample container.

7.3.4 Whenever possible, locate the sampler in a secured area to avoid loss or vandalism. If vandalism or flooding, etc. appears to be a probability, do not use an automatic sampler. If an automatic sampler must be used, secure it with chain and padlock.

7.3.5 For winter operation, the following precautions should be taken to avoid freezing of the sampler:

- Shorten the intake line to the minimum amount needed and remove any loops or sags that might collect water and freeze.
- Make sure the batteries are fully charged.
- Decrease the time interval between sample collections to help keep lines, etc., from freezing.
- Lower the sampler into a manhole or other shelter whenever possible.

8.0 REFERENCES

MDNR-FSS-001, Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations

MDNR-FSS-002, Field Sheet and Chain-of-Custody Record

MDNR-FSS-003, Sample Numbering and Labeling

MDNR-FSS-004, Field Documentation

MDNR-FSS-018, Sample Handling: Field Handling, Transportation, and Delivery to the ESP Lab

MDNR-FSS-201, Use, Cleaning, and Maintenance of ISCO Automatic Wastewater Samplers

Standard Methods for the Examination of Water and Wastewater, 1998, 20th Edition, Section 1060 B.